

Economic Impacts of Expanding Vermont's Renewable Energy Standards

PRELIMINARY RESULTS

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Objective and Approach

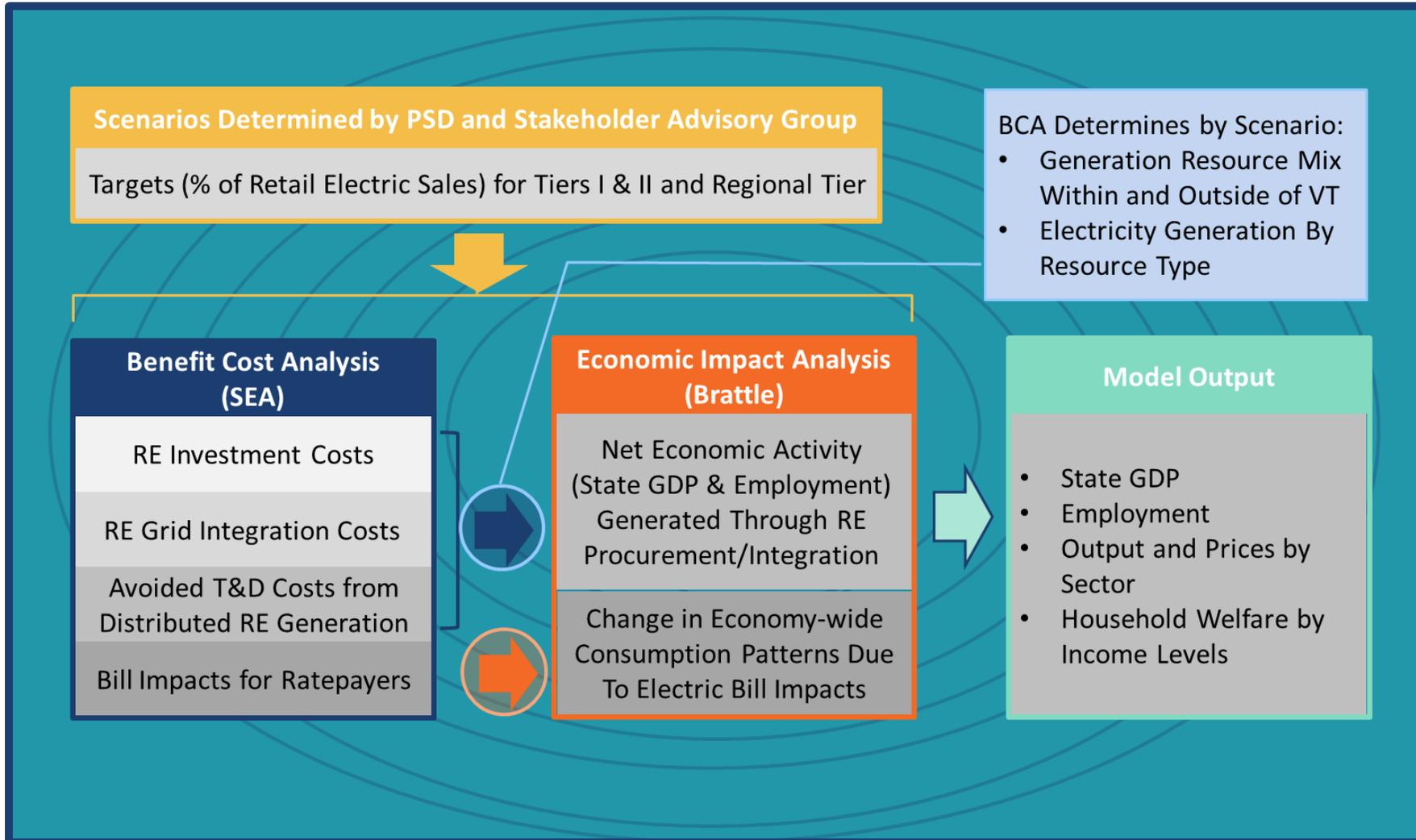
Project Objective

- Assess the macroeconomic impacts to Vermont under various scenarios of Vermont's Renewable or Clean Energy Standard (RES), including impacts to gross domestic product and employment.

Approach

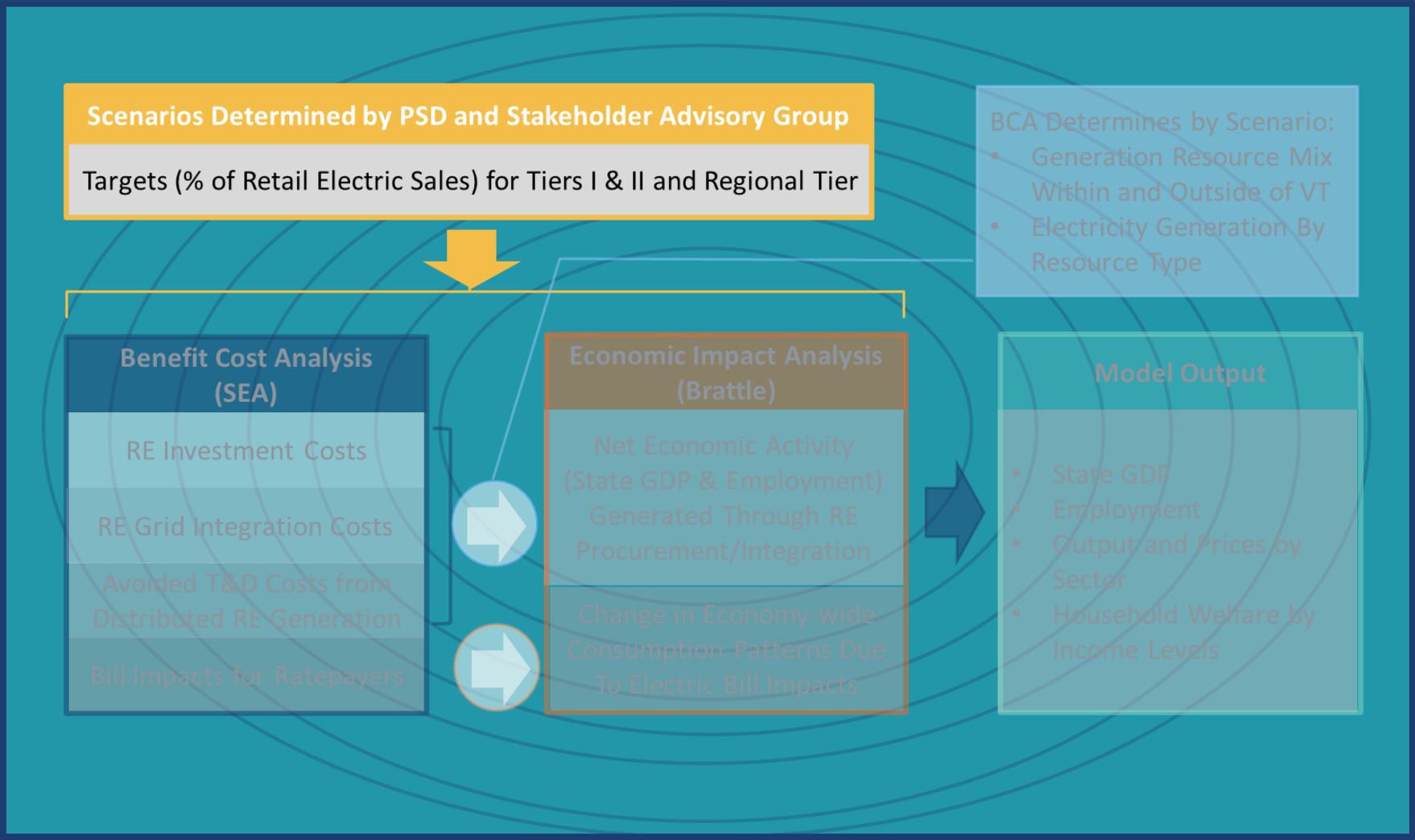
- Provide economic impact analysis (EIA) for six core scenarios regarding how to expand Vermont's RES. Scenarios were designed jointly by the Department of Public Service and Stakeholder Advisory Group.
- Maintain consistency with the Benefit-Cost Analysis (BCA) conducted by *Sustainable Energy Advantage, LLC* (SEA). BCA output such as rate impacts, incremental generating resource additions and incremental costs of renewable energy are used as inputs in the economic impact analysis.

Benefit-Cost & Economic Impact Analysis Overview



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Overview of Scenario Definitions



Overview of Scenario Definitions

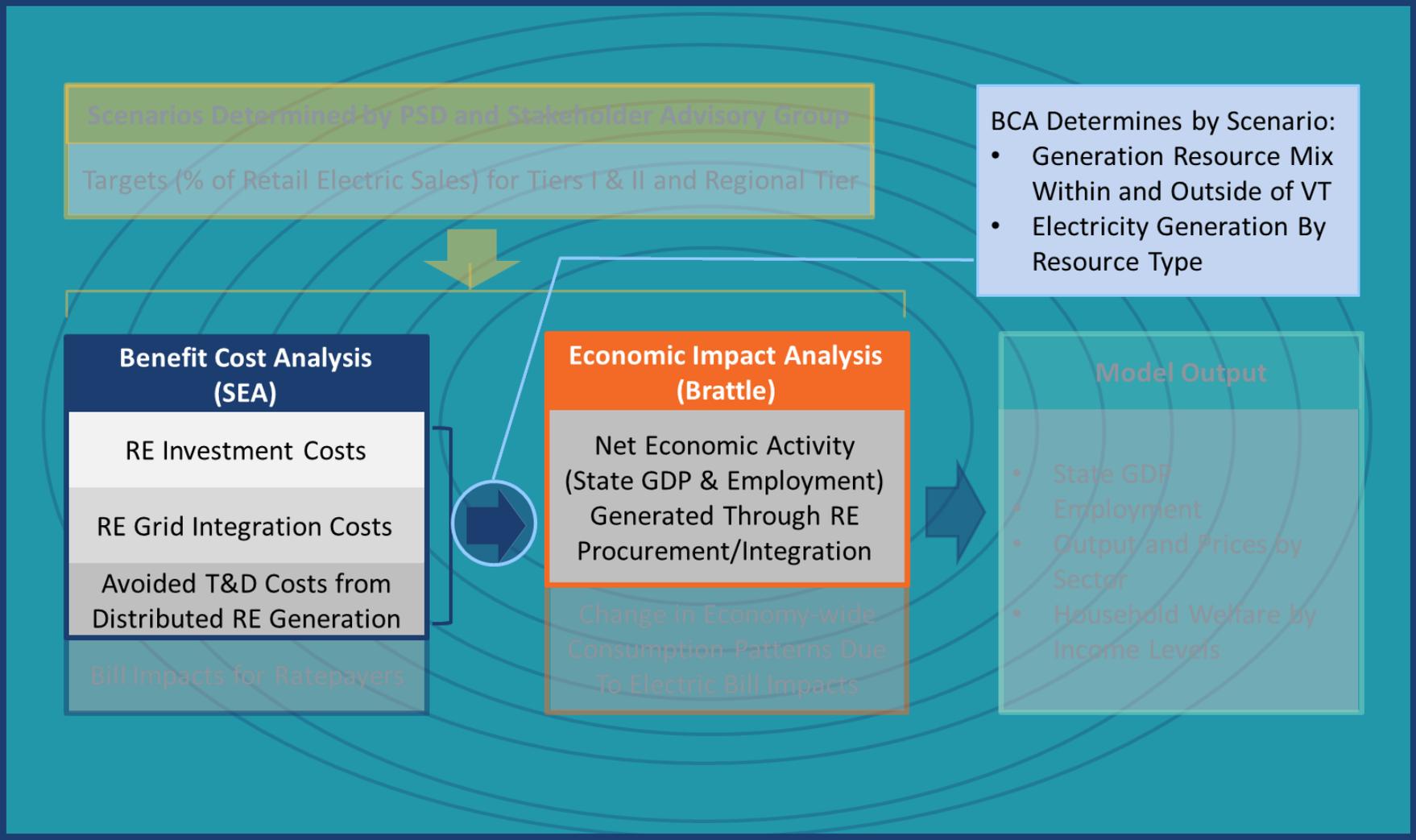
We model the six core scenarios defined by the Department and Stakeholder Advisory Group.

- **Business as Usual (BAU):** 75% by 2032 consisting of 10% Tier I, 65% Tier II.

Scenarios → Design Element ↓		BAU	Scenario 1: 100% RES	Scenario 2: 100% RES, incl. Regional Tier	Scenario 3: 100% CES	Scenario 4: 100% CES, incl. Regional Tier	Scenario 5: 100% RES, no biomass	Scenario 6: 100% CES, no biomass, Reg + T-II combo
Tier I, Net	Target	65%	70%	40%	70%	40%	50%	40%
	Target Date	2032	2035	2035	2035	2035	2035	2035
	Eligibility Changes	N/A	None	None	Add nuclear	Add nuclear	Remove biomass	Add nuclear; remove biomass
Tier II	Target	10%	30%	30%	30%	30%	20%	Combined with Regional Tier
	Target Date	2032	2035	2035	2035	2035	2035	
	Eligibility Changes	N/A	None	None	None	None	None	
Regional Tier	Target	N/A	N/A	30%	N/A	30%	30%	60%
	Target Date	N/A	N/A	2035	N/A	2035	2035	2035
	Eligibility*	N/A	N/A	2010+	N/A	2010+	2010+	2010+

- Six core scenarios varying allocation of tiers and technology eligibility in Tier I:
 - **Tier II:** 10%, 20%, 30%; **Regional Tier:** 0%, 20%, 30%, 40%, 50%; **Tier I:** Fills ‘gap’ to 100%
 - **Tier I eligibility:** with/without Biomass; with/without nuclear

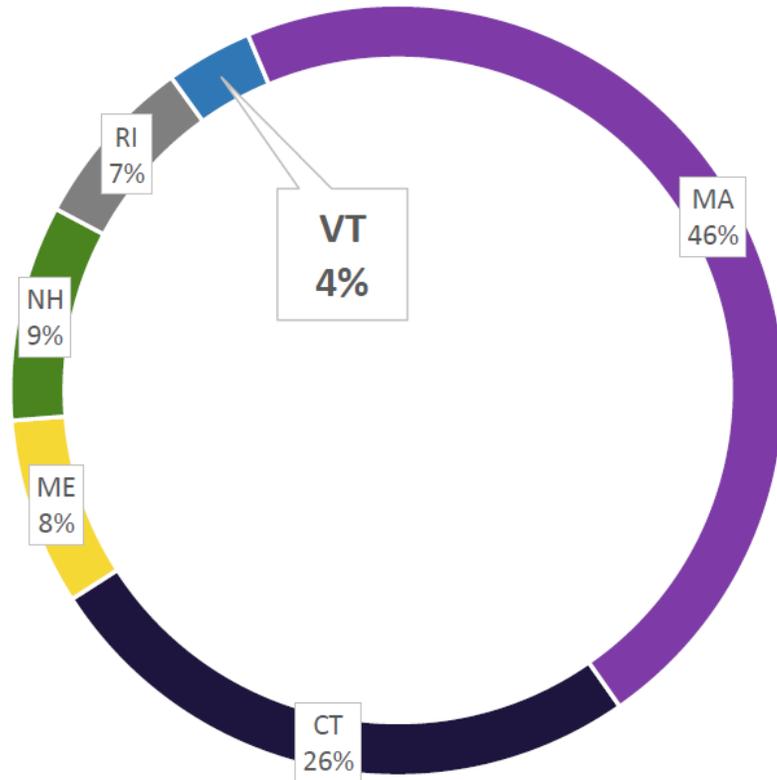
Investment Costs of Renewable Energy and Economic Growth



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RES Investment Costs Borne by Vermont

Percent of Forecasted 2025 Gross Summer Peak Load
ISO-NE 2023 CELT Report

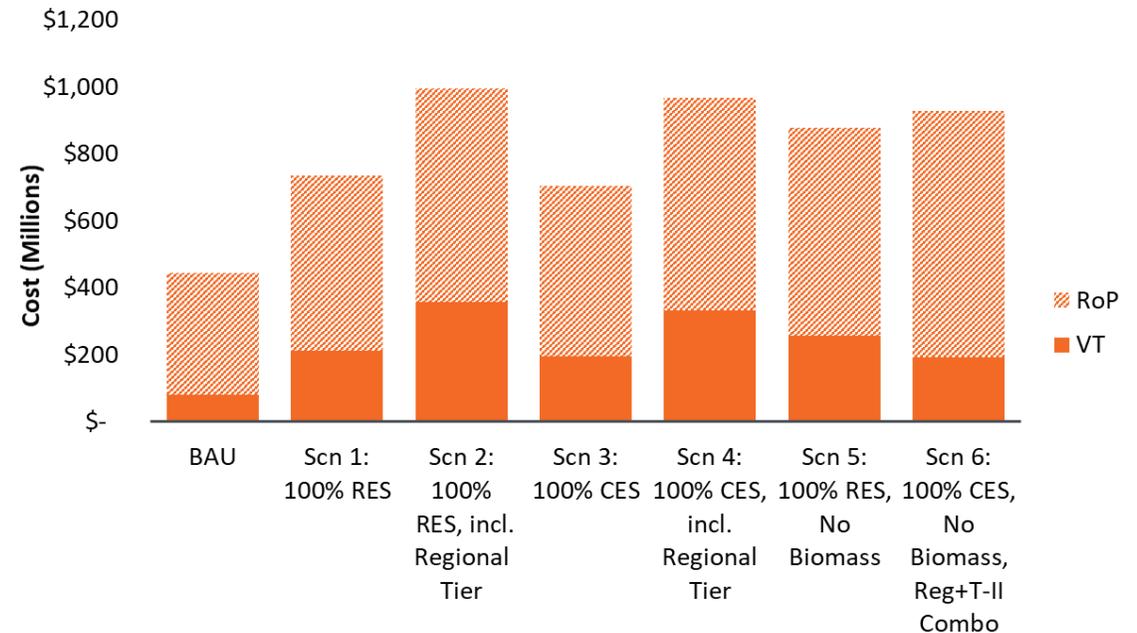


- Vermont consumers bear the costs of RES expansion:
 - Benefits of new renewable generation are shared by all New England ratepayers.
 - Vermont similarly benefits from resources driven by programs originating from other New England states.
 - In the BCA’s incremental cost calculation, only the 3-4% of benefits accruing to Vermont are accounted for.

Distribution of RES Investment: Vermont vs. Rest of Pool

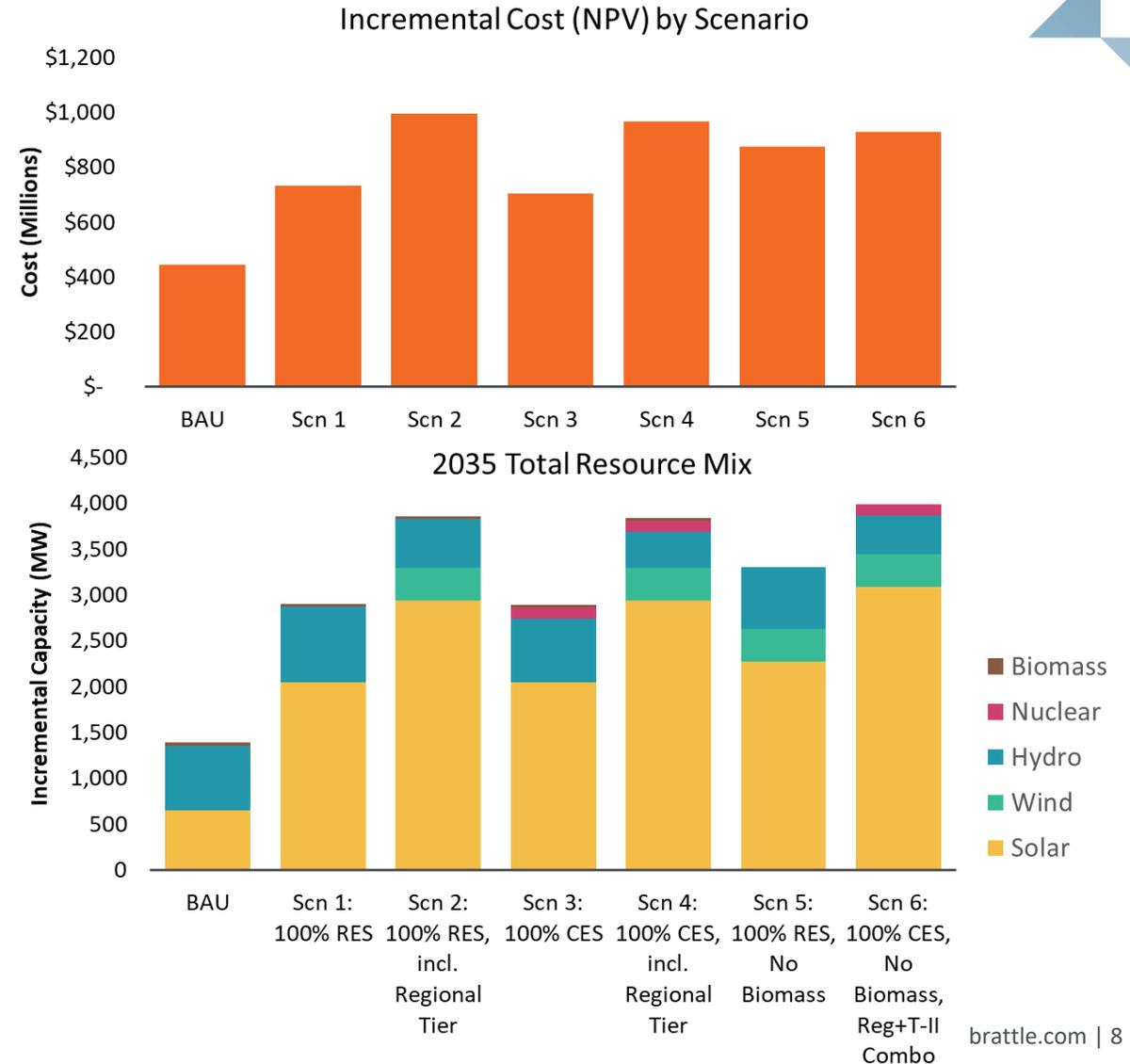
- BCA calculates investment costs as net incremental costs specific to the resources modeled relative to BAU.
- Incremental resources procured within Vermont create economic activity (increased state GDP and employment) predominantly within Vermont.
 - Projects within Vermont will still require some out-of-state and foreign industrial inputs.
- Out-of-state resource procurement projects are assumed to create economic activity in the rest of the pool (RoP).

Cost Breakdown of Incremental System Costs by Region:
VT vs. Rest of Pool (RoP)



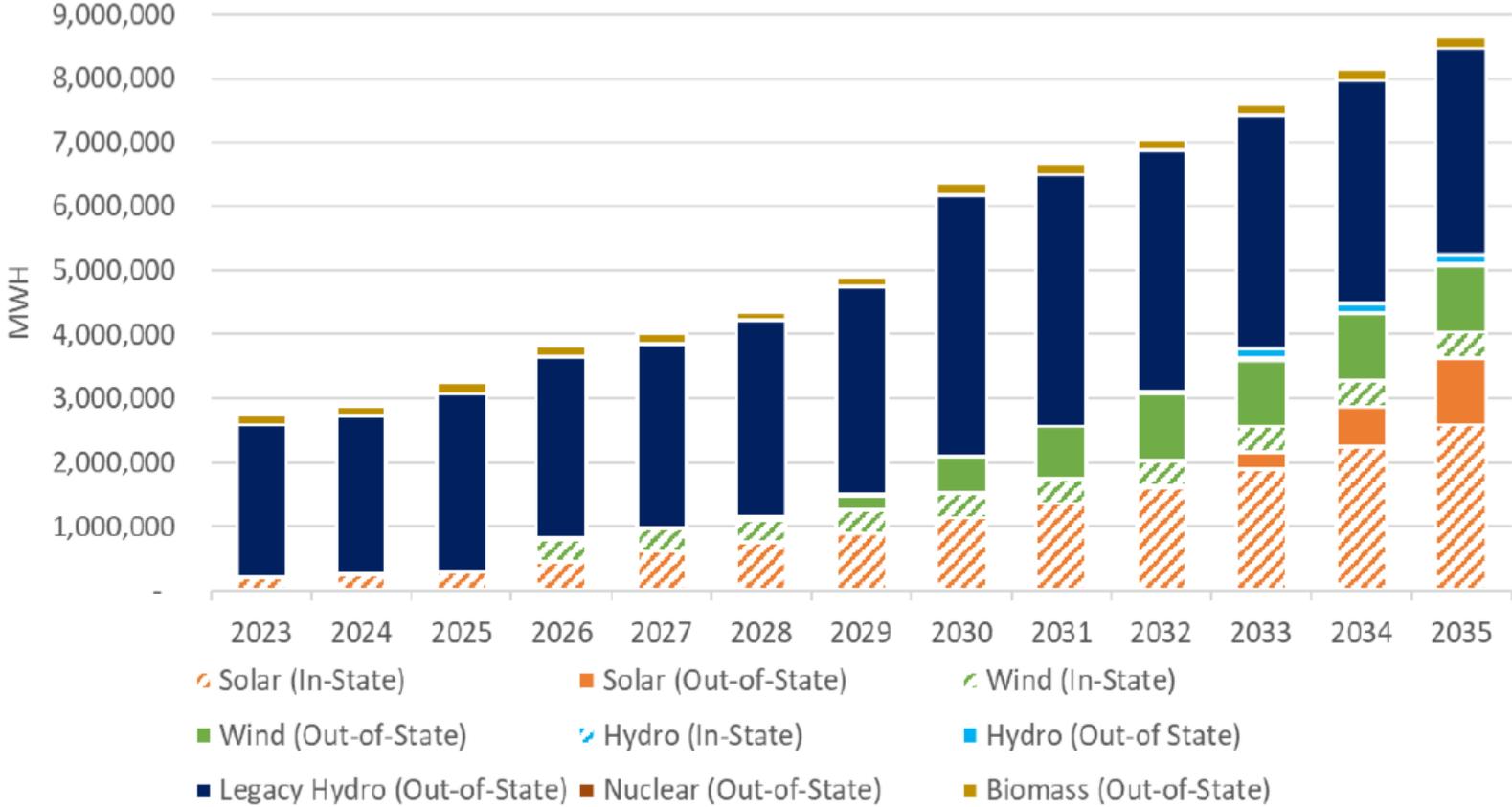
Distribution of RES Investment by Generating Resource Type

- BCA also provides incremental resource additions by scenario. Incremental renewable energy costs are used to invest in a scenario-specific resource mix.
- Costs incurred by Vermont’s electricity sector are payments to the production sectors of the economy involved in the procurement of resources
- Different resource types will use different (and different amounts of) industrial inputs; i.e., the resource mix will determine how investment costs are distributed throughout the economy.



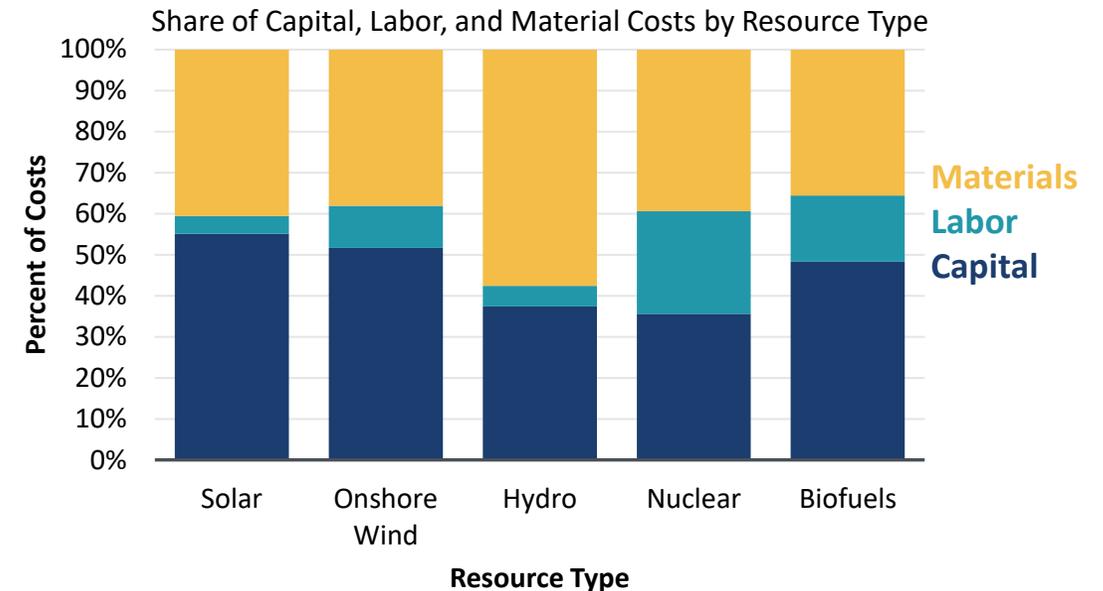
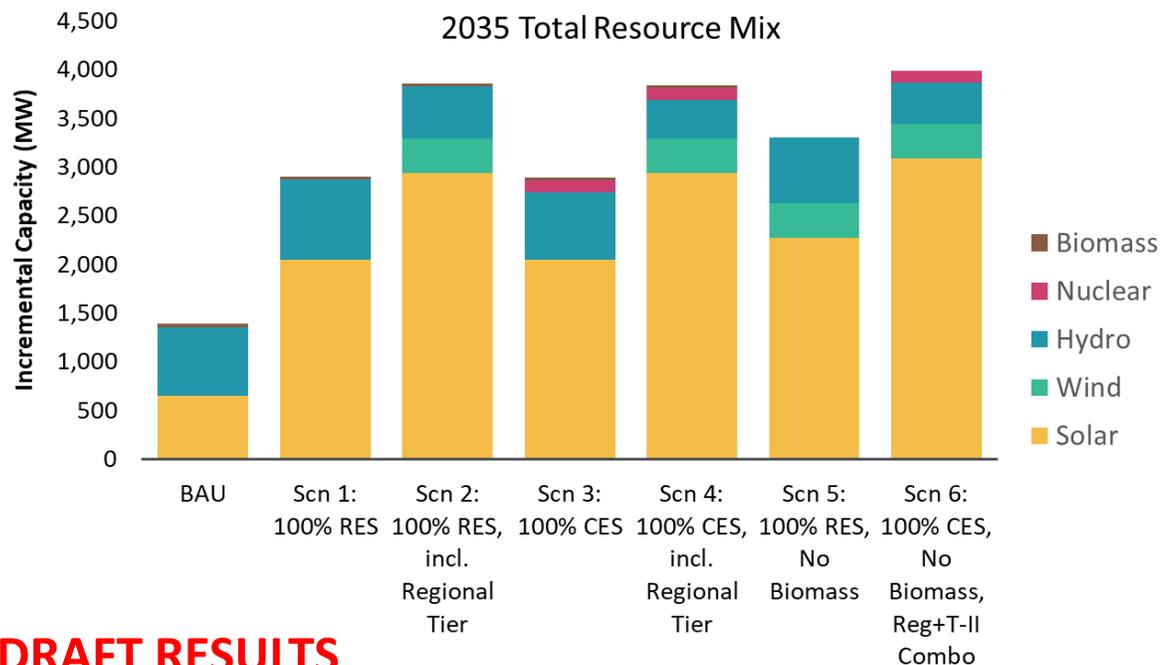
Distribution of RES Investment by Generating Resource Type

Technology Deployment in Scenario 2, SEA



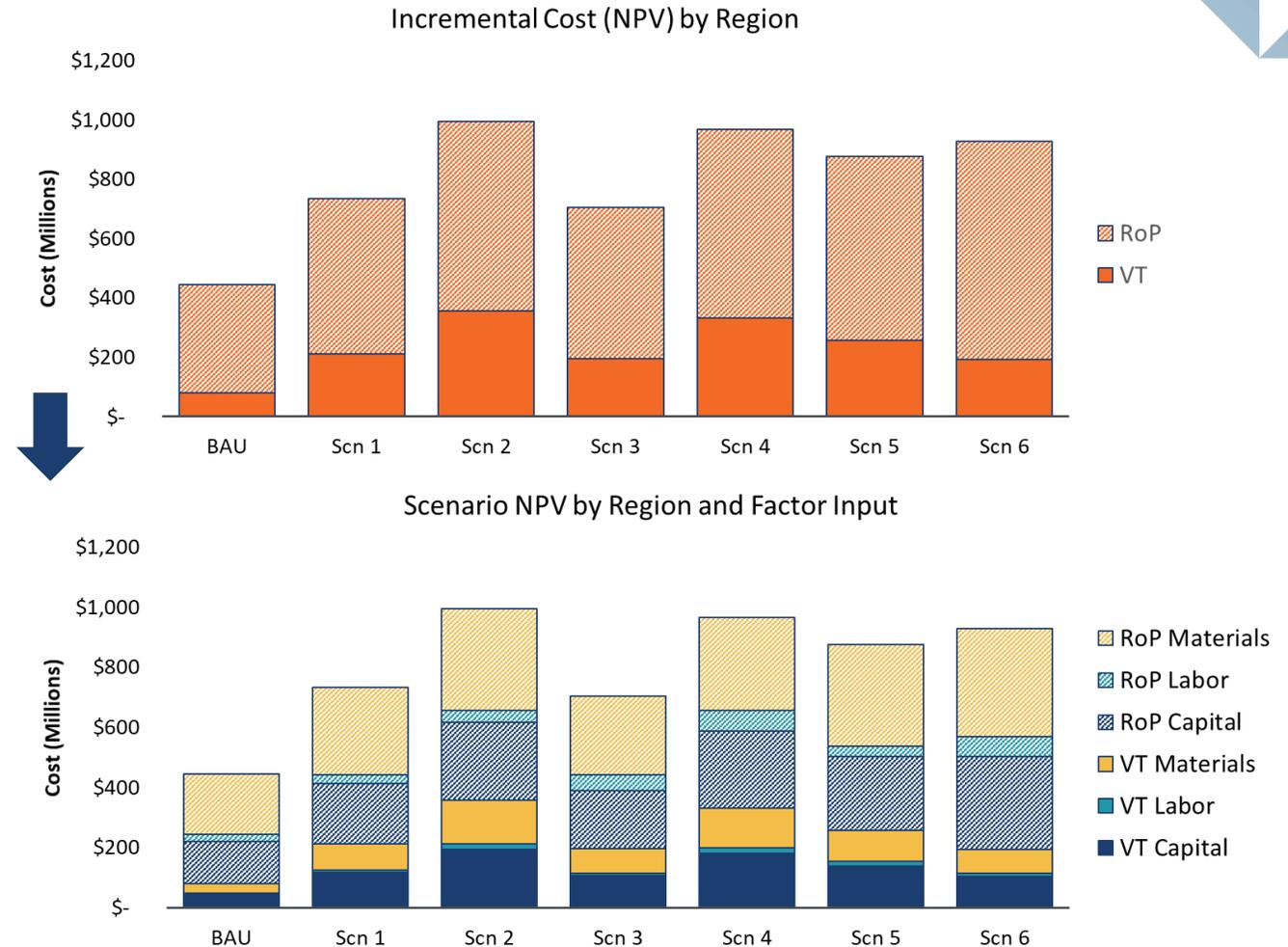
Translating RES Investment into Production Factors

- Electricity generation technology cost data from the Energy Information Administration (EIA), International Energy Agency (IEA) and the National Renewable Energy Laboratory (NREL), are used to breakdown resource costs into economic factors of production.
- Factors include physical capital (e.g., computers), labor employment and intermediate input goods (materials). Intermediate goods refer to goods produced by other sectors.

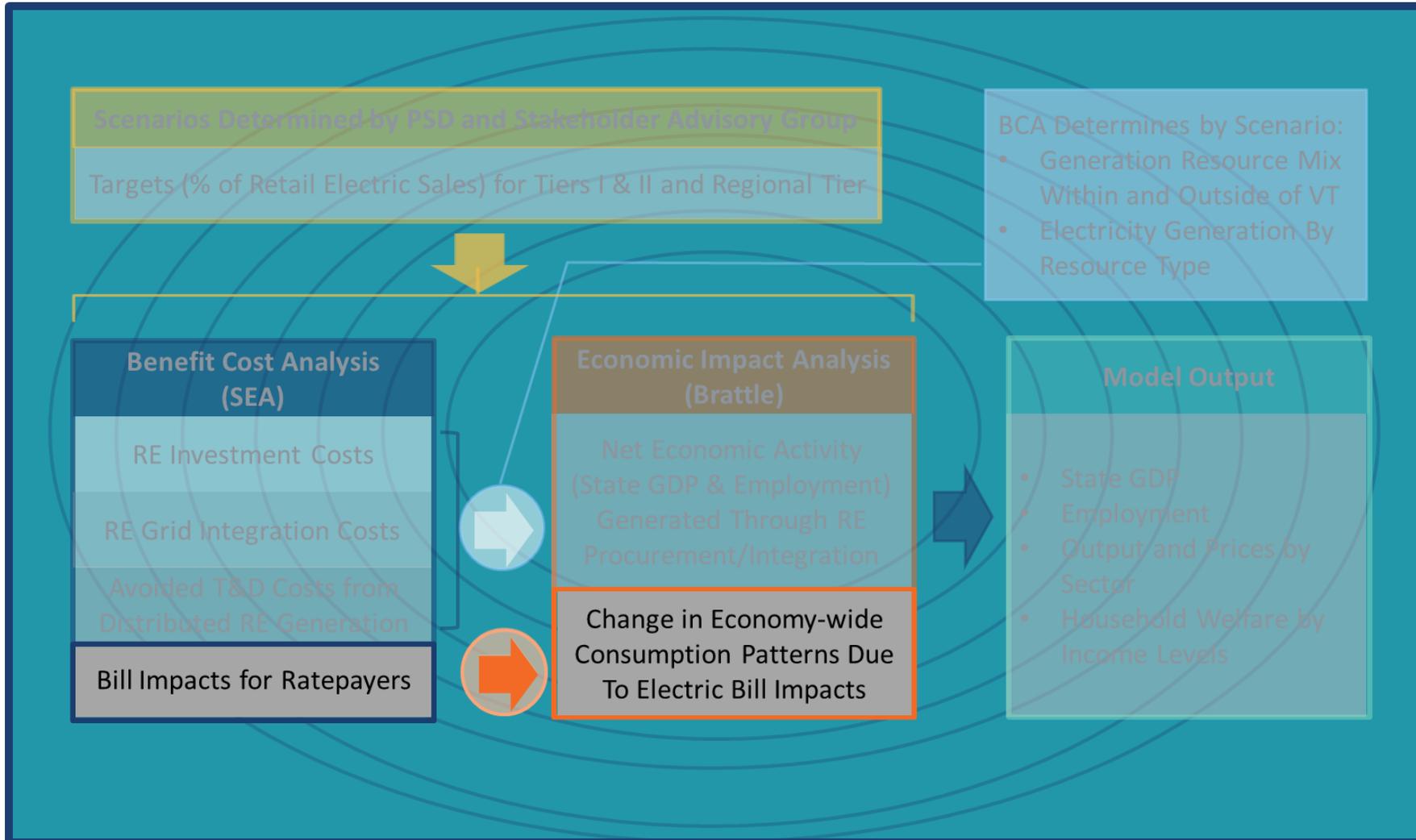


Translating RES Investment into Production Factors

- The result is each regional electricity sector's incremental factor use, which is obtained using:
 - Resource mix for each scenario
 - Geographic distribution of resources in Vermont and the rest of the pool
 - Resource cost breakdown into economic factors of production
- Procurement of renewable and clean energy resources in New England generates demand for other goods and services and creates price effects in the labor and capital markets.



Rate Impacts

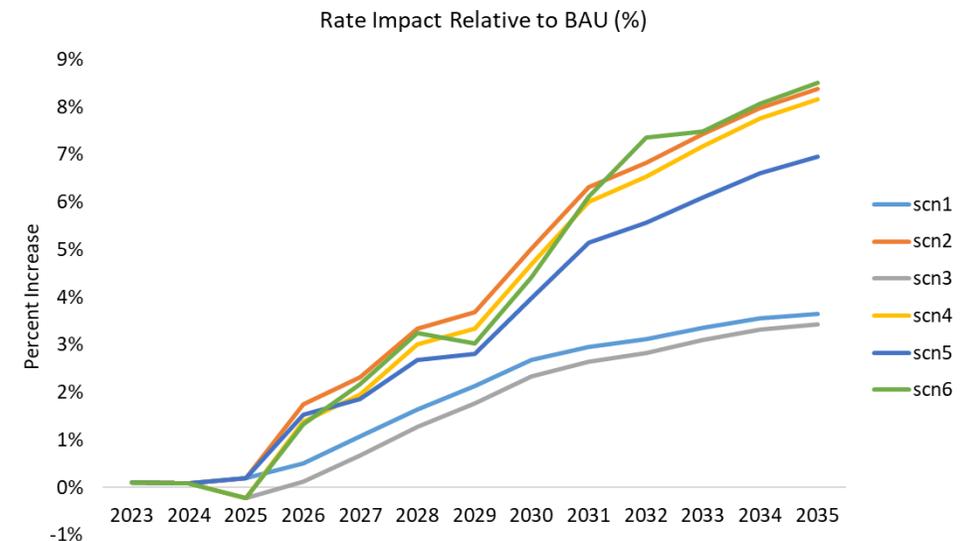
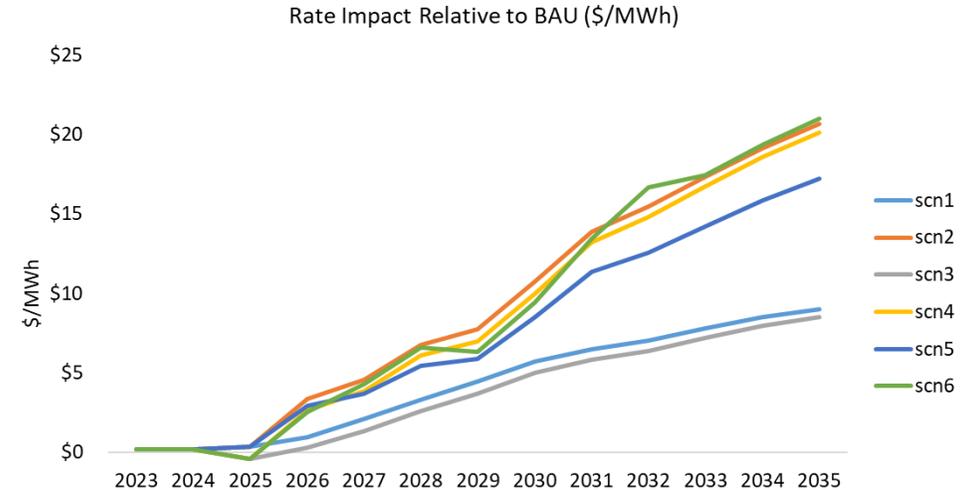


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Rate Impacts by Scenario

- Rates are expressed as change from the BAU scenario. Rates account for both incremental costs and benefits that would impact bills.
- BCA shows that rate impact increases as RES target increases.
- Scenario 6 has the highest rate impact in 2035. Rate increase relative to BAU reaches approximately 8.5% by 2035.
- All else equal, increased rates translate to less disposable income for ratepayers:
 - Less income for non-electricity goods can lead to decreased demand for those goods
 - Less budget for non-electricity inputs can induce less production in production sectors.

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BCA Perspective Used in Calculating Net Costs

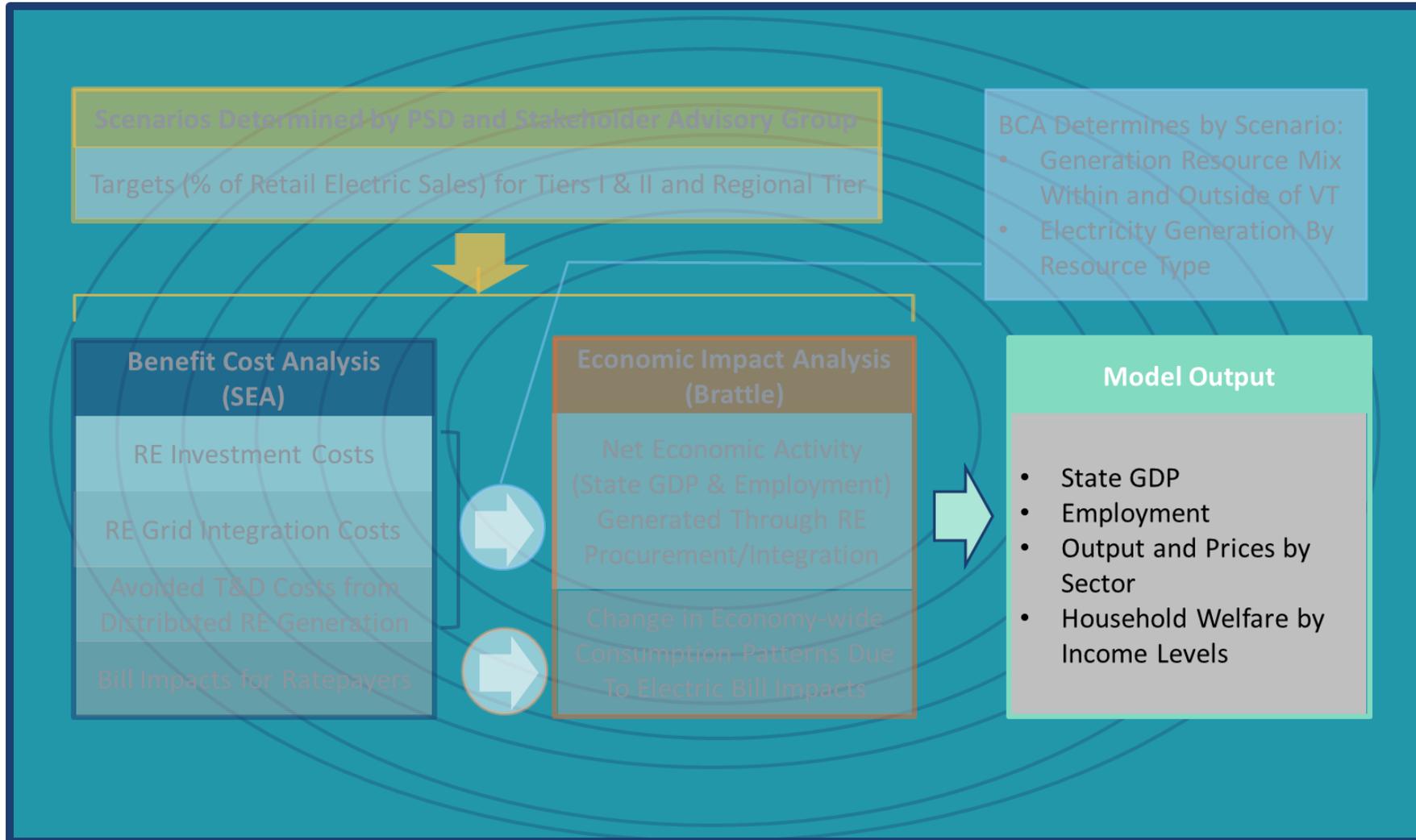
SEA outputs BCA results based on two perspectives: Reference Case

- Societal Cost Test (SCT)
 - Includes all market costs and benefits
- Ratepayer Impact Measure (RIM)
 - Includes only costs and benefits that would affect Vermont electricity bills

Economic impact analysis (EIA) uses the RIM-based BCA results.

Value Stream	Societal Cost Test (SCT)	Ratepayer Impact Measure (RIM)
Incremental cost of resource	Cost	Cost
Transmission integration costs	Cost	Cost (VT only)
Intercxn distribution system upgrades	Benefit	Benefit
Uncleared capacity value	Benefit	Benefit (VT only)
Reduced share of capacity costs →	N/A	Benefit
Price suppression	Benefit	Benefit (VT only)
Avoided transmission costs	Benefit	Benefit (VT only)
Reduced share of transmission costs →	N/A	Benefit
Reduced distribution costs	Benefit	Benefit
Reduced transmission losses	Benefit	Benefit (VT only)
Reduced distribution losses	Benefit	Benefit
Improved generation reliability	Benefit	Benefit (VT only)
Non-embedded GHG emissions	Benefit	N/A
NOx emissions	Benefit	N/A
Local pollutants	Benefit	N/A
RE development land use	Cost (not monetized)	N/A
Fossil fuel water use	Benefit (not monetized)	N/A

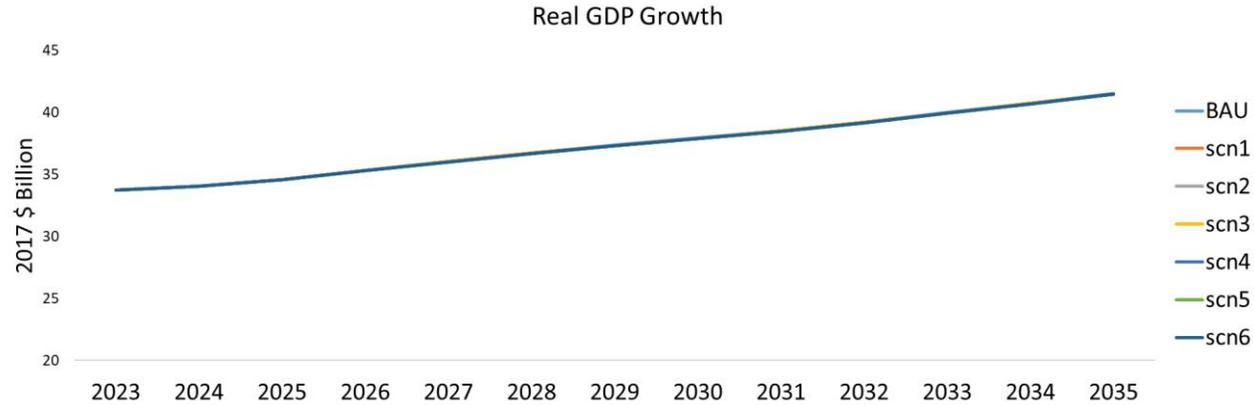
Macroeconomic Impacts



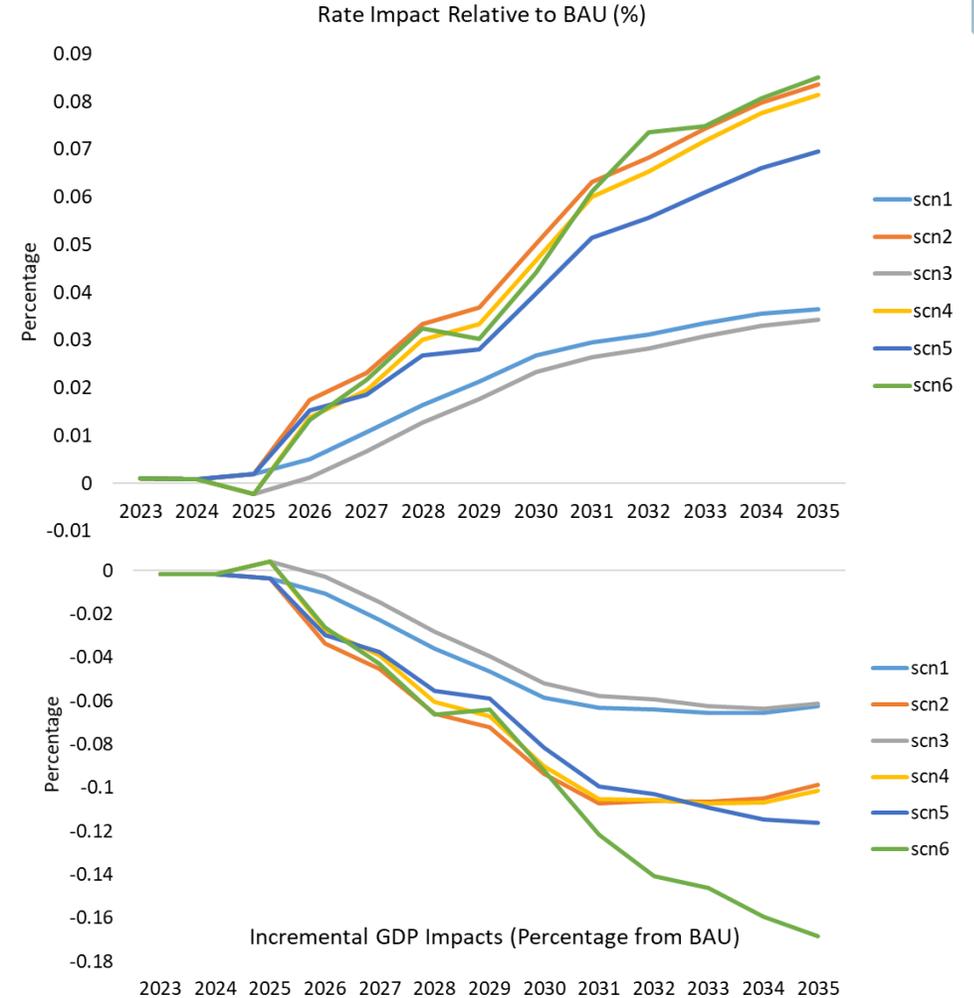
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Economic Impacts: GDP Growth

- GDP grows but at a *slightly* slower rate relative to BAU

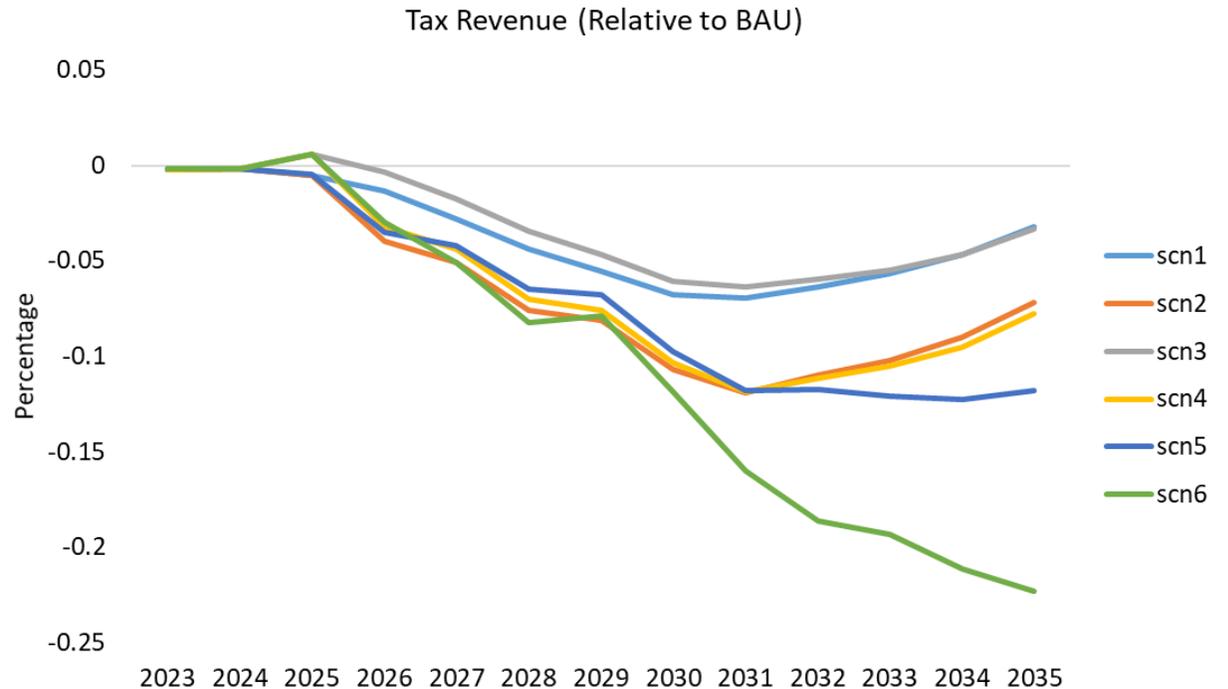


- Incremental GDP impacts are driven by rate changes:
 - Increase in rates results in less disposable income for consumers and producers to spend on non-electricity goods and services.
 - Although investment from RES expansion results in increased economic activity, decreased economic activity from increased rates becomes the dominant effect.

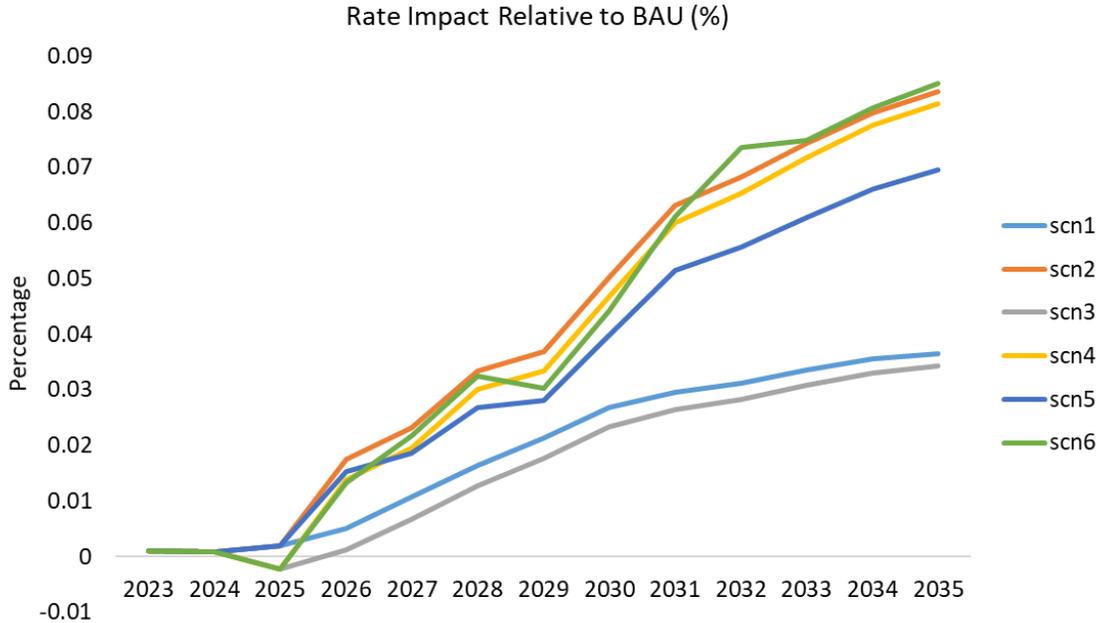
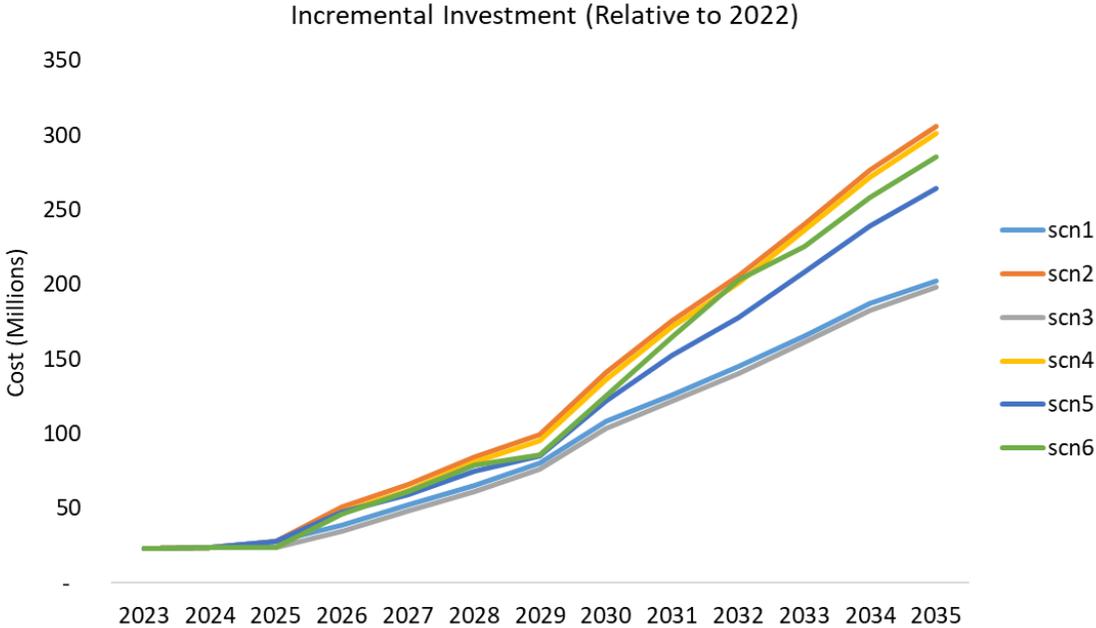


Economic Impacts: Tax Revenue in Vermont

- In general, tax revenue grows at a similar rate to GDP.
- Tax revenue is directly impacted by economic activity.
- Tax revenue increases in the renewable energy investments that take place in Vermont.
- Revenue decreases in electricity rates as higher rates result in reduced economic activity for ratepayers.
- Scenario 6 sticks out due to the high portion of out-of-state resources included in the RES resource mix.

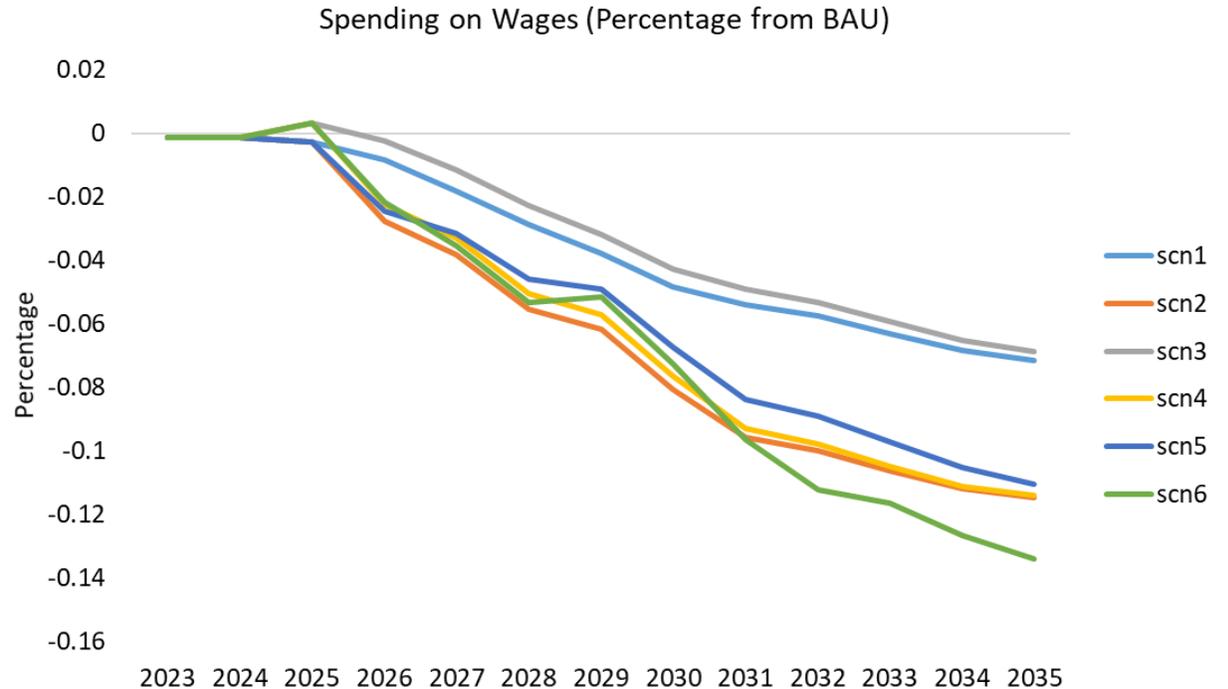


Economic Impacts: Tax Revenue in Vermont



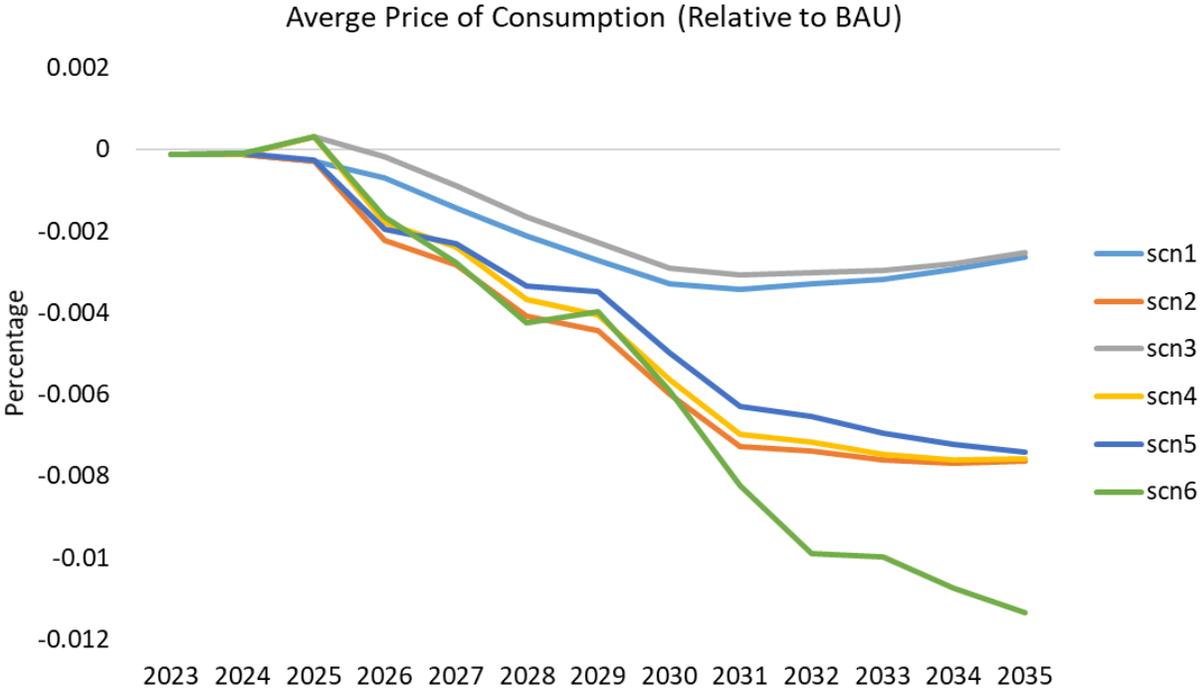
Economic Impacts: Employment in Vermont

- In general, net employment grows at a *slightly* slower rate compared to BAU.
- Employment is directly impacted by economic activity, resulting in similar effects to GDP impacts.
- Employment increases with the renewable energy investments that take place in Vermont.
- Employment decreases with electricity rates as higher rates result in reduced economic activity for ratepayers.



Economic Impacts: Consumer Price Index in Vermont

- Growth in the Consumer Price Index (CPI) follows a similar trajectory as GDP growth.
- The CPI increases in economic activity through renewable energy investments, and decreases in electricity rates.
 - Higher rates result in reduced economic activity for ratepayers.



Appendix



Renewable Energy Investments in Vermont by Scenario

